



PCT/AU2004/001484

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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003905992 for a patent by SUNSHINE HEART COMPANY PTY LTD as filed on 30 October 2003.



WITNESS my hand this  
Ninth day of November 2004

A handwritten signature in cursive script, appearing to read 'J. Billingsley'.

JULIE BILLINGSLEY  
TEAM LEADER EXAMINATION  
SUPPORT AND SALES

**AUSTRALIA**

**Patents Act 1990**

**PROVISIONAL SPECIFICATION FOR THE INVENTION ENTITLED:**

**A Wrap**

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**Name and Address of Applicant:**

Sunshine Heart Company Pty Ltd, an Australian company ACN 090 552 300, of  
Top Floor, Unit 2, 10 Rodborough Road, Frenchs Forest, New South Wales,  
2086, Australia

**Names of Inventors:**

Scott Hugh Miller and William Suttle Peters and Gemma de Plater

**This invention is best described in the following statement:**

# **A WRAP**

## **Field of the Invention**

5 The present invention relates to a wrap for securing about a blood vessel, and in particular for holding a vessel deformer adjacent an arterial vessel.

The invention has been primarily developed for use in securing the inflatable balloon or chamber of an implantable counter-pulsation heart assist device against the ascending aorta and will be described hereinafter with reference to this application.

## **Background of the Invention**

10 The Applicant's International PCT Patent Application Nos. PCT/AU00/00654 and PCT/AU01/01187 disclose heart assist devices, systems and methods. More particularly, these specifications disclose vessel deformers in the form of inflatable balloon or chambers which form part of implantable counter-pulsation heart assist devices. The balloon or chambers are cyclically inflated and deflated and used to  
15 compress the patient's ascending aorta during diastole and release the compression during systole.

The balloon or chamber are generally secured to the aorta by a substantially non-elastic wrap or sheath, which is secured around a section of the aorta with the balloon or chamber therebetween. For the heart assist device to function efficiently, it is necessary  
20 that the wrap be a snug fit around the aorta when the balloon or chamber is deflated.

Hitherto, wraps have been manufactured from a length of substantially inflexible woven polyester material. The disadvantage of known wraps will be described with reference to Fig. 3 which shows a section of aorta 10 encased by a known wrap 12. If the wrap 12 is over-tightened (as shown), its sides cause a sharp depression or kink in the  
25 aorta 10, in the regions indicated by the reference numeral 14. This can also occur due to the aorta 10 enlarging slightly as the patient recovers or with age. This depression/kinking places a higher strain on the wall of the aorta 10 and can damage same. Also, the kink in the internal wall of the aorta 10 induces turbulence in the blood flow, which increases the likelihood of plaque formation.

30 Wrapping a curved vessel with a flat straight piece of fabric also leads to bunching or folding of the fabric. This is undesirable as it encourages secondary growth or potential infection in the bunched/folded region and results in uneven load distribution.

It is also known to place static wraps around blood vessels, for instance to reinforce vessels suffering from aneurysmal disease.

Any aortic compliance may be lost by placement of non-elastic or non shape-changing wrap, which may reduce the natural advantage of aortic compliance on cardiac function.

5 It is an object of the present invention to provide a wrap that substantially overcome or at least ameliorate one or more of the above disadvantages.

### Summary of the Invention

Accordingly, in a first aspect, the present invention provides a wrap for securing about a blood vessel by encasing a section of the vessel, the wrap being of thin flexible construction having two ends and two sides, the wrap being more elastic or stretchable at,  
10 near or along at least some of its sides compared to at, near or along its centre, to provide strain relief from wrapped to unwrapped aorta.

It is preferable that the wrap is not inelastic, and that loss of aortic compliance is minimised, or in fact enhanced.

In a second aspect, the present invention provides a wrap for securing about a  
15 blood vessel by encasing a section of the vessel, the wrap being of thin flexible construction having two ends and two sides and being adapted to apply, in use, less compressive force at, near or along at least some of its sides compared to at, near or along its centre.

The wrap is preferably adapted to securing a vessel deformer adjacent the vessel,  
20 by sandwiching the deformer between the vessel and the wrap. The vessel deformer is preferably part of an implantable counter-pulsation heart assist device and most preferably is in the form of an inflatable balloon or chamber. The wrap is preferably adapted to secure the inflatable balloon or chamber against an aorta, most preferably the ascending aorta.

25 The wrap is preferably of woven or knitted construction, or a combination, and made of material such as polyester or PET (polyethylene terephthalate).

In one form, the wrap has slits along some of its sides, most preferably a series of spaced part slits that are normal to the direction of the sides. The slits make those parts of the sides more elastic or stretchable than the centre of the wrap.

30 In another form, the wrap has warp fibres at, near or along its sides that are more elastic than the warp fibres at, near or along its centre. In this form, the warp fibres, near or along its sides are preferably crimped and the warp fibres at, near or along its centre are preferably un-crimped or less crimped.

In another form, the wrap includes a strip of substantially centrally placed material, that has a tensile strength greater than that of the rest of the wrap.

The two sides of the wrap can be of similar, or differing, elasticity or stretchability to each other. In the case of differing, the more elastic or stretchable side is positioned  
5 closer to the heart, as this is where there is greater movement

In a yet further form, the wrap is thinner at, near or along its sides compared to at, near or along its centre.

The wrap is preferably about six times longer than it is wide, most preferably with a slimmed region at or near its longitudinal midpoint. The wrap desirably includes one or  
10 more, preferably two, longitudinal slits near its thinned region to allow the wrap to conform radially more closely with the inner curve of the aorta. The wrap is preferably shaped to allow good conformance with the curved aorta – the slits allow improved conformity. The wrap preferably also includes an opening for a fluid tube.

In another embodiment the wrap may be coated with a material to reduce its  
15 surface area and to limit tissue ingrowth. The wrap is preferably coated on one or both sides with either silicone or polyurethane or a co-polymer of both.

### **Brief Description of the Drawings**

Preferred embodiments of the present invention will now be described, by way of examples only, with reference to the accompanying drawings in which:

- 20 Fig. 1 is a top view of a first embodiment of a wrap according to the invention;  
Fig. 2 is a perspective view of the wrap shown in Fig. 1;  
Fig. 3 is a schematic cross-sectional view of a prior art wrap around an aorta;  
Fig. 4 is a schematic cross-sectional view of the wrap shown in Fig. 1 around an aorta;  
25 Fig. 5 is a partial top view of a second embodiment of a wrap according to the invention; and  
Fig. 6 is a partial top view of a third embodiment according to the invention.

### **Detailed Description of the Preferred Embodiment**

Referring firstly to Fig. 1 and 2, there is shown a wrap 20 according to a first  
30 embodiment of the invention. The wrap 20 is produced from woven DACRON and includes ends 22, 24 and sides 26, 28.

The wrap 20 includes an opening 30 for a fluid tube to be connected to, for example, the inflatable balloon or chamber (not shown) of a heart assist device. The wrap 20 also includes a thinned region with a pair of curved longitudinal slits 32, which serve

to prevent the wrap from kinking or folding when it is wrapped around a curved portion of aorta.

About two-thirds of the sides 26, 28 of the wrap 20 include a series of spaced apart slits 34 which are substantially normal to the longitudinal axis of the wrap 20. These slits 34 results in those parts of the sides 26, 28 of the wrap 20 being more elastic or stretchable than the intermediate central portion of the wrap 20. As a result, when the wrap 20 is placed around a section of aorta and tightened to a snug fit, less tension is placed in the sides 26, 28 or edges of the wrap 20 than in the centre. This avoids the depression/kinking, and associated high strain levels, associated with known wraps (as was discussed in relation to Fig. 3).

A schematic illustration of the wrap 20 around a section of aorta 36 is shown in Fig. 4. The regions 38 of the aorta 36 adjacent the sides 26, 28 of the wrap have a smooth curved transition from a larger to smaller diameter. These curved transition regions 38 result in less strain in the wall of the aorta 36, which reduces the chance of damage to same. The curved transition zones 38 also reduce turbulence in the blood flow through the aorta 36 and thereby reduce the likelihood of plaque formation.

A second embodiment of wrap 40 is shown in Fig. 5. In this embodiment, the wrap 40 according to the invention is again of woven DACRON construction with longitudinal warp fibres 42 and lateral weft fibres 44. In the wrap 40, the warp fibres 46 adjacent the sides of the wrap 40 are made crimped which makes them more elastic or stretchable than the un-crimped warp fibres 48 in the centre of the wrap 40.

Fig. 6 shows another embodiment of wrap 50 according to the invention which is again of woven polyester construction. The wrap 50 includes a second polyester strip 52 attached to its centre. The strip 52 has a tensile strength greater than that of the rest of the wrap 50 which results in the sides 54, 56 being more elastic or stretchable than the centre 52.

It will be appreciated by persons skilled in the art that numerous variations and/or modifications can be made to the invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly defined.

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**Dated 30 October, 2003**  
**Sunshine Heart Company Pty Ltd**  
**Patent Attorneys for the Applicant**  
**SPRUSON & FERGUSON**

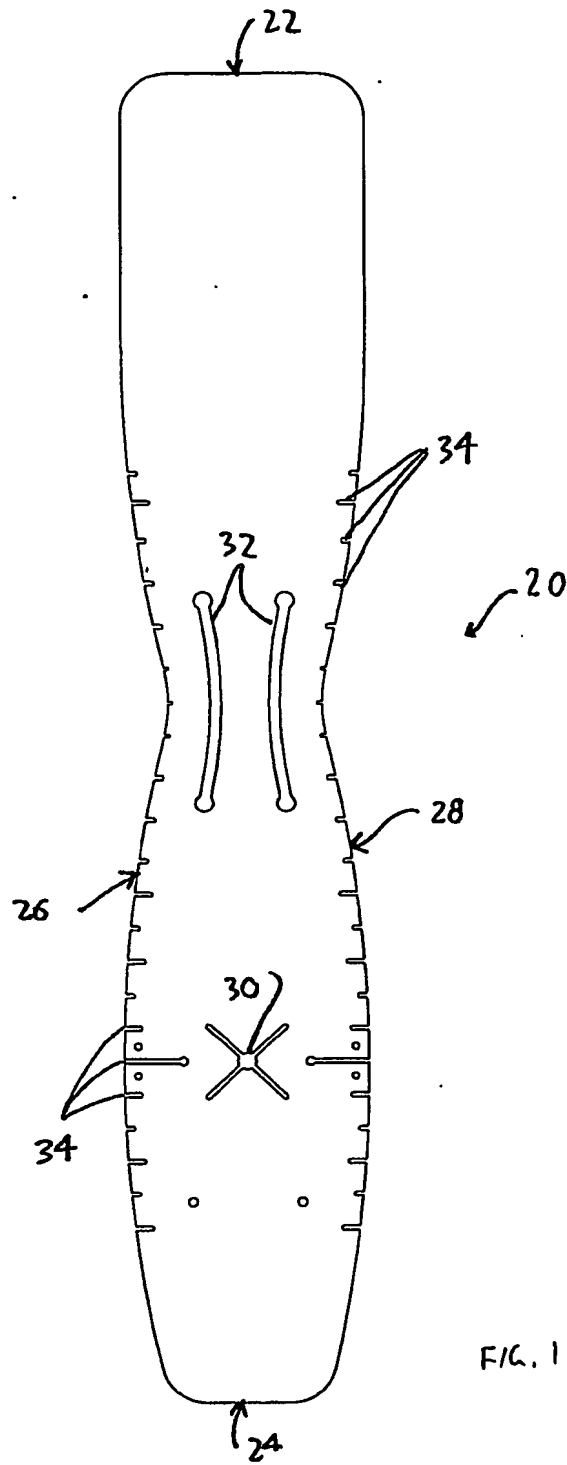
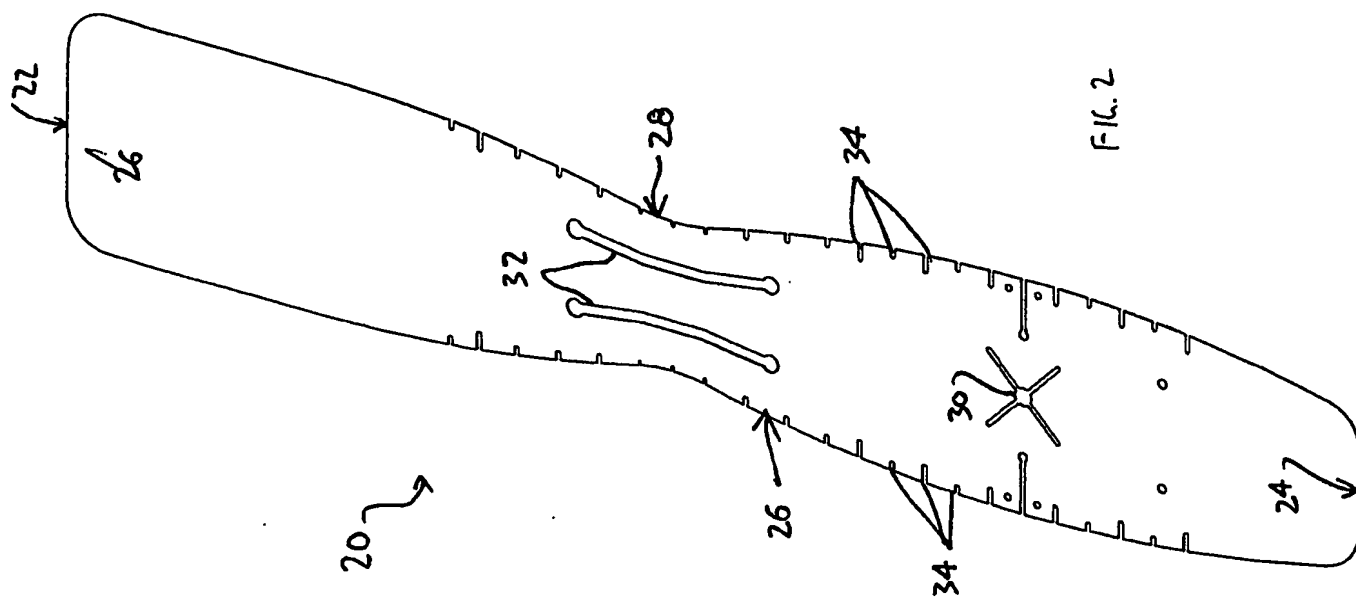


FIG. 1





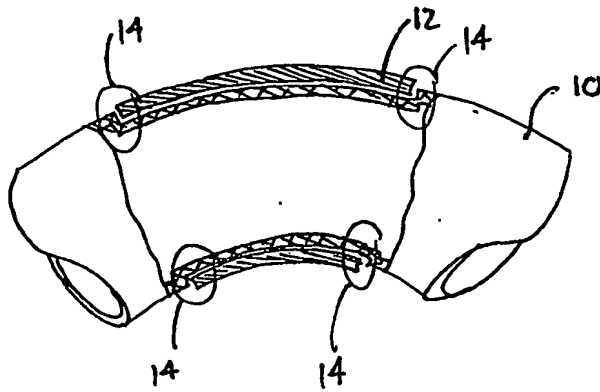


FIG. 3

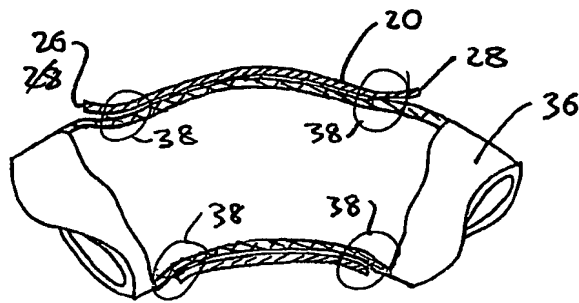


FIG. 4

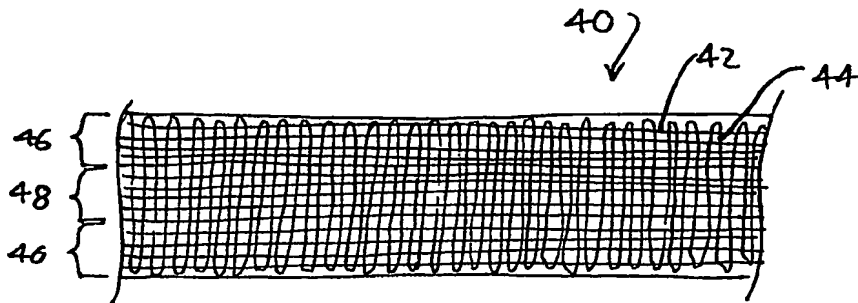


FIG. 5

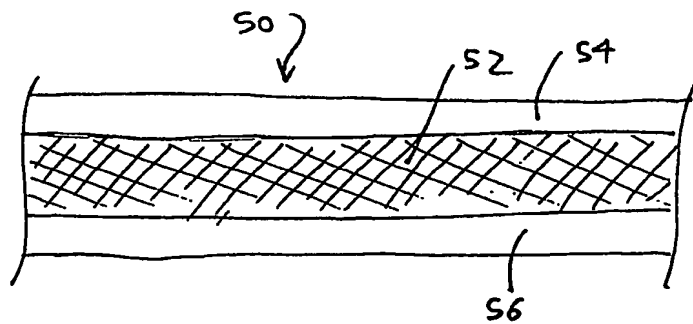


FIG. 6

# Document made available under the Patent Cooperation Treaty (PCT)

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